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INFORMATION SYSTEM FOR MANAGEMENT OF EXCESS TACTICAL
WHEELED VEHICLES - FUNCTIONAL DESCRIPTION(U) ARMY
CONCEPTS ANALYSIS AGENCY BETHESDA MD J J CONNELLY

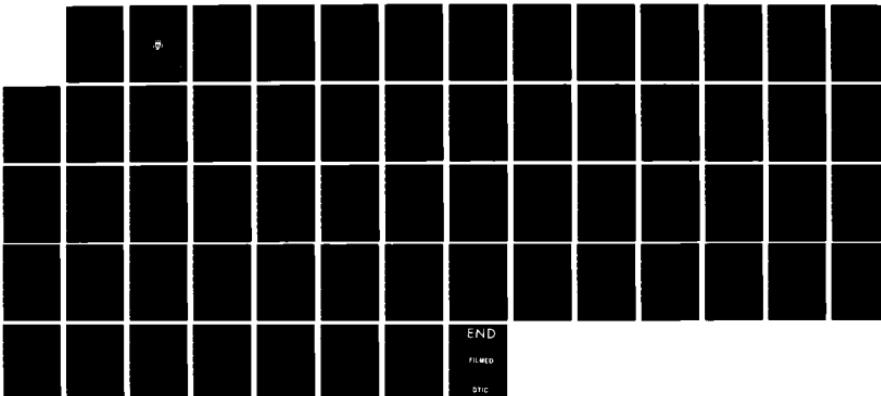
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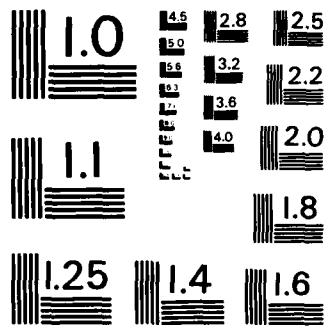
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TECHNICAL PAPER
CAA-TP-85-7

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INFORMATION SYSTEM FOR MANAGEMENT OF EXCESS TACTICAL WHEELED VEHICLES

FUNCTIONAL DESCRIPTION

JUNE 1985



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PREPARED BY
FORCE SYSTEMS DIRECTORATE

US ARMY CONCEPTS ANALYSIS AGENCY
8120 WOODMONT AVENUE
BETHESDA, MARYLAND 20814-2797

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FOREWORD

This functional description has been prepared to document the results of an informal 2-month working relationship between the Office of the Deputy Chief of Staff for Logistics, Tank-Automotive Logistics Office (DALO-SMT), and the US Army Concepts Analysis Agency (CAA). The relationship was established to permit CAA to contribute a systems analysis perspective to the planning for the management of the redistribution of tactical wheeled vehicles made excess by the introduction of modernization vehicles into the force.

It was recognized that the Army Staff (ARSTAF) management effort involved is substantial, due both to the quantity of vehicles involved and the 5-plus year time period over which the excesses will be generated and redistributed. With this volume of activity in mind, it was determined that the system, for ARSTAF management oversight purposes, would project redistribution activity for future time periods, aggregated by installation, within the continental United States (CONUS) and aggregated by major Army command (MACOM) outside CONUS. The individual redistribution actions would continue to be carried out at the MACOM level, using existing procedures and products. The data products from the proposed system would be primarily for ARSTAF use in carrying out the oversight function.

The information in support of the oversight function is generated using Total Army Equipment Distribution Program (TAEDP) data products to identify both equipment excesses in units and equipment shortages in other units. Then, projections are made as to the extent to which excesses could be used to satisfy shortages. The use of TAEDP data for this purpose recognizes that the data may be incomplete, and that one or more of the initiatives underway to improve this data (see Appendix C) will have to mature to provide fully satisfactory outputs from the proposed system.

The functional description of the system herein is meant to capture the significant issues of the system design and provide a point of departure for system implementation. The format of this document follows that prescribed for the Functional Description in Department of Defense (DOD) Automated Data Systems Documentation Standard 7935, February 1983, with adaptations to the system at hand. It is intended that the first phase of the system implementation be a design phase which translates the function description into specific program and data base requirements as described in DOD STD 7935. For the microcomputer-based system, the design effort can be simplified through the use of commercial software packages. A data base package could be used to manage the input data, and a spreadsheet package could be used to manipulate and display the output data.

The activities and timeframes associated with the development of the system are broadly addressed in the discussion of the System Development Plan (Chapter 4). A more specific identification of the resources and milestones would be prepared by the system developer. The organizational responsibilities need to be formally assigned in accordance with the organizational and operational impacts (page 2-3, paragraph 2-3b) provided in this functional description.

A significant feature of the system presented in this description is its general applicability to the management of other excess items (e.g., radio). For these other application areas to be realized, the input data would have to reflect the other equipments and the output report headings would have to be modified to reflect the appropriate equipment nomenclature.



INFORMATION SYSTEM FOR MANAGEMENT OF EXCESS
TACTICAL WHEELED VEHICLES - FUNCTIONAL DESCRIPTION
(Analytic Assistance to the Tank-Automotive
Logistics Office - ATALO)

STUDY
SUMMARY
CAA-TP-85-7

THE REASON FOR PERFORMING THE STUDY was to incorporate a systems analysis perspective into the planning for the Army staff management of the redistribution of tactical wheeled vehicles made excess by the introduction of modernization vehicles into the force.

THE PRINCIPAL FINDING was that the Army Staff will require ongoing information on the availability of excess equipments and on shortages of such equipment in other units which can be satisfied by the excess equipment.

THE MAIN ASSUMPTION was that Total Army Equipment Distribution Program data products would be sufficiently timely to permit identification of excesses and shortages.

THE PRINCIPAL LIMITATION was that ARSTAF guidance limited vehicle redistribution by geographic areas, namely within installations in the Continental United States (CONUS), and within major Army commands outside CONUS.

THE SCOPE OF THE STUDY was limited to tactical wheeled vehicles, although the methodology for management would be applicable to other types of equipment, e.g., radios.

THE STUDY OBJECTIVE was to provide ARSTAF logisticians with a quantitative basis for the management of the redistribution of excess tactical wheeled vehicles, including associated maintenance resource requirements.

THE BASIC APPROACH was to: (1) determine the information required to provide an Army staff overview of the availability and potential redistribution of excess vehicles, (2) evaluate the sources of data available and the processing of the data necessary to fulfill these information requirements, (3) define an information system encompassing these elements in a structured manner, and (4) document the system in a Functional Description for an Information System for Management of Excess Tactical Wheeled Vehicles (CAA Technical Paper 35-7).

THE STUDY SPONSOR was the Chief, Tank-Automotive Logistics Office (DALO-SMT).

THE STUDY EFFORT was directed by Mr. James J. Connelly, Force Systems Directorate.

COMMENTS AND QUESTIONS may be directed to the Director, US Army Concepts Analysis Agency, ATTN: CSCA-FS, 8120 Woodmont Avenue, Bethesda, Maryland 20814-2797.

Tear-out copies of this synopsis are at back cover.

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**INFORMATION SYSTEM FOR MANAGEMENT OF EXCESS TACTICAL
WHEELED VEHICLES**

FUNCTIONAL DESCRIPTION

CHAPTER 1

INTRODUCTION

1-1. PURPOSE OF THE FUNCTIONAL DESCRIPTION. This functional description is written to provide:

- a. The system requirements to be satisfied which will serve as a basis of mutual understanding between the system user and the system developer.
- b. Information on performance, preliminary design, impacts, and implementation of the system.
- c. A reference for test and acceptance of the system, as implemented.

1-2. REFERENCES

- a. Documents
 - (1) Total Army Equipment Distribution Program (TAEDP) User's Manual, Depot System Command (DESCOM) Pamphlet No. 700-1, 7 May 1983
 - (2) TAEDP Monthly Requisition Validation Report User's Manual, DESCOM Pamphlet No. 700-3, 31 March 1983
 - (3) Message, DALO-SMD 152002Z, June 1984, subject: Policy and Procedures for the Management of Excess/Displaced Major End Items
 - (4) Message, DALO-SMD 172325Z, May 1985, subject: Redistribution/Disposition of Class VII Equipment
 - (5) AR 5-9, Intraservice Support Installation Area Coordination, 1 March 1984
 - (6) AR 11-11, War Reserves, 15 January 1982 (CONFIDENTIAL)
 - (7) AR 750-1, Army Materiel Concepts and Policies, 1 December 1983
 - (8) DA PAM 700-25, Class VII Substitution List, 1 April 1984

RPT DATE: 10 JUN 85
DATA DATE: 31 MAY 85

DISPLACED AND SHORT EQUIPMENT

TWH /2/

HORIZON: PLANNING
AREA: OCONUS
SITE: USAREUR

FY	TWH TYPE	DEPLOYED UNITS			WAR RESERVES			POW/MIA			TOTALS		
		TOTAL UNITS	TOTAL EQP UNITS	TOTAL SHORT	TOTAL UNITS	TOTAL EQP UNITS	TOTAL SHORT	TOTAL UNITS	TOTAL EQP UNITS	TOTAL SHORT	TOTAL UNITS	TOTAL EQP UNITS	TOTAL SHORT
1	1	2	2	3	3	3	4	4	4	4	4	4	4
2	2	2	2	3	3	3	4	4	4	4	4	4	4
3	1	2	2	3	3	3	4	4	4	4	4	4	4
4	1	2	2	3	3	3	4	4	4	4	4	4	4
5	1	2	2	3	3	3	4	4	4	4	4	4	4
6	1	2	2	3	3	3	4	4	4	4	4	4	4
7	1	2	2	3	3	3	4	4	4	4	4	4	4

NOTE: SEPARATE DISPLAY
GENERATED FOR EACH SITE IN
OCONUS FOR PLANNING AND
EXECUTION HORIZONS

Figure 3-3. Excess TWH - Outside CONUS

(2) Excess TWV - Outside CONUS

Display No: TWV /2/

Description: This display would indicate the aggregated quantities of excess equipment and short equipment for a particular MACOM by fiscal year (planning horizon) or fiscal quarter (execution horizon).

Purpose: Provides a summary of the magnitude of the excess and shortages within the site before the redistribution is carried out. Excesses are apparent both in terms of the number of units/stockpiles and the amount of equipment involved, for both deployed units and stockpiles.

Illustration: (See Figure 3-3.)

RPT DATE: 10 JUN 85
DATA DATE: 31 MAY 85

DISPLACED AND SHORT EQUIPMENT

HORIZON: PLANNING
AREA: CONUS
SITE: FT HOOD

TWW /1/

FY	TWW TYPE	ACTIVE UNITS			RESERVE UNITS			GUARD UNITS			TOTALS		
		TOTAL UNITS	TOTAL EQP EXCESS	TOTAL EQP SHORT	TOTAL UNITS	TOTAL EQP EXCESS	TOTAL EQP SHORT	TOTAL UNITS	TOTAL EQP EXCESS	TOTAL EQP SHORT	TOTAL UNITS	EOP EXCESS	TOTAL EQP SHORT
1	1	1	1	1	1	1	1	1	1	1	1	1	1
	2	2	2	2	2	2	2	2	2	2	2	2	2
	3	3	3	3	3	3	3	3	3	3	3	3	3
	4	4	4	4	4	4	4	4	4	4	4	4	4
	5	1	1	1	1	1	1	1	1	1	1	1	1
	6	1	2	2	3	3	4	4	4	4	3	4	4
	7	1	2	2	3	4	4	4	4	4	3	4	4

NOTE: SEPARATE DISPLAY
GENERATED FOR EACH SITE IN
CONUS FOR PLANNING AND
EXECUTION HORIZONS

Figure 3-2. Excess TWW - Inside CONUS

(1) Excess TWV - Inside CONUS

Display No: TWV /1/

Description: This display would indicate the aggregated quantities of excess equipment and short equipment for a particular installation and associated support area by fiscal year (planning horizon) or fiscal quarter (execution horizon).

Purpose: Provides a summary of the magnitude of the excess and shortages within the site before the redistribution is carried out. Excesses are apparent both in terms of the number of units involved and the amount of equipment involved, for both active and reserve components.

Illustration: (See Figure 3-2.)

f. Display Description and Illustration. The information system displays are described and illustrated on the following pages. See paragraph 3-3b for a description of the individual display fields.

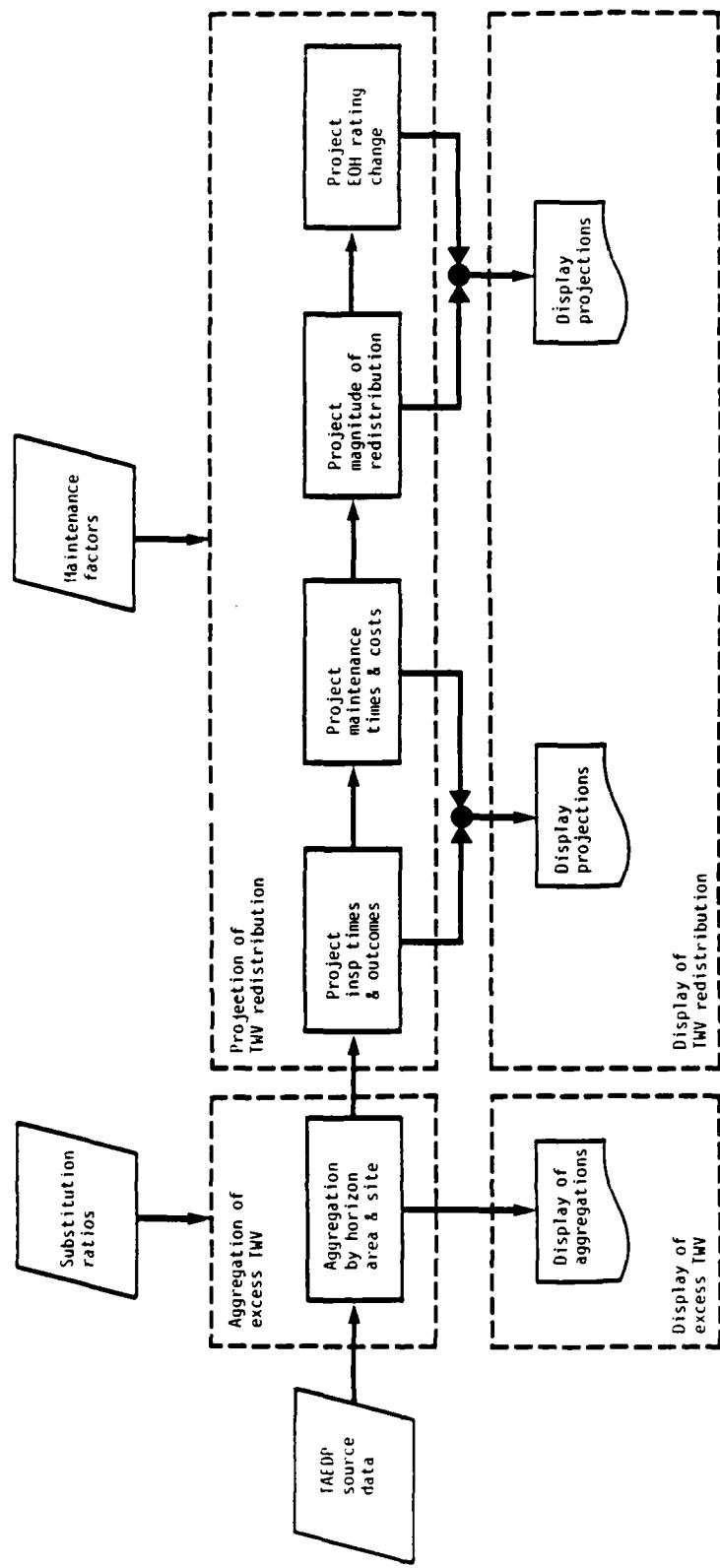


Figure 3-1. System Functions and Relationships

c. Projection of TWV Redistribution

(1) Projection of Redistribution Workloads. The workloads associated with inspection and maintenance of the excess TWV are projected by site, that is, by installation (CONUS) and MACOM (OCONUS).

(2) Projection of Redistribution Magnitude and Improvement

(a) Redistribution Guidance. The basic ARSTAF guidance (Reference 1-2a(3)) provides for distribution of excess to the short element with the highest unit priority. It has been suggested, however, that this rule may generate a ripple effect in the transfer of the equipment. That is, the higher priority unit may receive the excess vehicle one year, only to receive its modernized counterpart the next. The initial excess vehicle now again becomes excess and another cycle of reissue is involved. To minimize such occurrences, it has been proposed that the initial redistributions be made to the units with the lowest priority, rather than those with highest priority. This should get the vehicles to units where they would likely remain. The lowest-priority approach has been referred to as the "one-time redistribution" rule. In the most recent ARSTAF guidance (Reference 1-2a(4)), redistribution is limited to units not expecting modernization equipment within 24 months.

(b) Redistribution Magnitude. The proposed system achieves the overview perspective of the redistribution by aggregating, for each site, the short equipments, by type. A similar aggregation is made of all the excess equipments, by type, at the site. A transfer of the aggregated excess equipment is then made against the aggregated shortages.

(c) Redistribution Improvement. The magnitude of the redistribution (above) provides an absolute measure of the redistribution. The improvement achieved by the redistribution is a relative measure which gauges the extent to which there has been an increase in meeting the requirements for the equipment. The measure is generated by taking the ratio of the magnitude of the redistribution to the magnitude of the requirements associated with short units and expressing the result as a percentage (e.g., a 12 percent improvement). A separate measure is computed for each redistributed equipment, by type, at each redistribution site.

(d) Display of TWV Redistribution. For clarity in presentation sequence, the material appears in paragraph 3-2f beginning on page 3-5.

e. Function Summary. The information system functions are shown summarized with their interrelationships in Figure 3-1.

basis for the 7 years of the planning cycle (current year, budget year, and 5 Program Objective Memorandum (POM) years). The short-term information is referred to as execution information and is considered on a quarter fiscal year (QFY) basis for a 2-year period. The nature of the information reported is the same, but the data system origin and/or processing is different.

(2) **Redistribution Areas.** Redistribution within CONUS involves different considerations than redistribution OCONUS. Within CONUS, there are additional military elements with a claim on the redistributed assets, namely, the US Army Reserve, the National Guard, and CONUS war reserves. In overseas locations, the claimants, in addition to deployed units, are theater war reserves and stocks associated with the prepositioned materiel configured to unit sets (POMCUS).

(3) **Redistribution Sites.** Implicit in the redistribution process is the consideration of transportation costs. A basic guideline has been established based on VCSA guidance. This guidance calls for the minimization of the TWV movement involved by redistributing within specific geographic subareas (sites). In response to this guideline, the strategy employed for the information system limits redistribution, by installation within CONUS, including the installation's associated intraservice support area (see Reference 1-2a(5)), and by MACOM including war reserves (see Reference 1-2a(6)) outside CONUS. Any equipment in excess, after satisfying shortages within the "site," are to be referred to the AMC item manager for disposition.

(4) **Summary.** The basic organization of the excess TWV data reflecting the concepts of data horizon, redistribution area, and redistribution site are shown in Table 3-1.

Table 3-1. Organization of Aggregated Excess TWV Information

Data horizons	CONUS redistribution	OCONUS redistribution
Planning and execution	Installation/support area Active unit Reserve unit Guard unit	MACOM Deployed unit War reserve POMCUS

b. **Display of Excess TWV.** The excess TWV are reported by site, that is, by installation inside of CONUS and by MACOM outside CONUS. The report is described and illustrated in paragraph 3-2f beginning on page 3-5.

CHAPTER 3

DETAILED CHARACTERISTICS

3-1. SPECIFIC PERFORMANCE REQUIREMENTS

a. Accuracy and Validity

(1) **Historical Data.** The historical data must be selected for a time period which is of sufficient duration to be representative of the experience with the vehicles in question. Within this data, a statistically valid sample must be chosen. This selection process should include a sensitivity analysis of equipment utilization factors (e.g., mileage for vehicles) as they influence the values computed. It has been noted that the historic data may be biased toward vehicles with substantial maintenance needs, due to the practice of turning in vehicles in the poorest condition. As larger volumes of vehicles are turned in with more widely varying repair needs, it will be important to update the database with the more recent values reflecting the wider mix of maintenance conditions. This will significantly improve the original estimates using solely historical data.

(2) **TAEDP Data.** TAEDP data accuracy is a consequence of the accuracy of data in the systems which provide input to it. Ultimately, it is dependent upon the posting procedures and practices with which the data is input into the system, including the promptness with which the updated information is reported.

b. **Timing.** The timing is understood to be the frequency with which data is generated by the system. The lower limit is the monthly frequency with which data is input into the TAEDP via reporting channels. For the purposes of the proposed system, the output is generated at 3-month intervals keyed to fiscal-year quarters.

3-2. SYSTEM FUNCTIONS. The information system performs the following functions:

a. **Aggregation of Excess TWV.** The excess TWV are aggregated by information horizon, redistribution area, and redistribution site as described in the following paragraphs.

(1) **Information Horizon.** Unanticipated events in the physical distribution of the modernization equipment, combined with tardiness in reporting of excess equipment, after units take delivery of the new items, combine to introduce a level of uncertainty into the information passed up reporting channels. As a result, there may be a difference between the information reported in the short term (monthly) and the corresponding information reported in the long term (annually) with respect to the excess TWV available for redistribution. For the purposes of the present system, two horizons of information are provided. The long-term information, referred to as planning information, is considered on a fiscal year (FY)

(4) Developmental Impacts

(a) Microcomputer-based Development. The proposed system anticipates the use of microcomputer technology to process historical inspection and maintenance data on vehicle types corresponding to the excess type TWV. It would also be used to generate the excess vehicle summaries from data bases constructed from current TAEDP products. The hardware, software, and personnel resources associated with this development are anticipated to be located at the MACOM level, specifically the item manager office.

(b) TAEDP-based Development. The proposed system anticipates the use of both existing and new TAEDP products (References 1-2a(1) and 1-2a(2)). The existing TAEDP product is the monthly Requisition Validation Report (REQVAL). The new TAEDP products would project excess equipment, by unit, at installations (inside CONUS) and by MACOM (OCONUS) and eventually incorporate excesses directly into the distribution process. These enhancements would be a part of ongoing development by the TAEDP system developer, the Depot System Command (DESCOM).

2-4. ASSUMPTIONS AND CONSTRAINTS

- a. The system is focused on projecting upcoming redistribution activity and does not track or summarize accomplished redistributions.
- b. The projections make use of factors derived from historical data and are dependent upon the availability and representativeness of the historical data with respect to the current equipment conditions.
- c. The system is designed to provide a management level overview of the redistribution activity. It does not simulate or otherwise track individual or unit redistribution actions.
- d. It is assumed that discrepancies in unit holdings, as reflected in CBS-X input to TAEDP, can be adjusted so as to achieve useful system outputs (see Appendix C).
- e. Redistribution is made with no representation for lags in equipment availability due to maintenance times. This lag effect is partially offset by the time periods over which the projections are made.
- f. The redistribution activity does not address the associated support items of equipment (ASIOE) which may accompany the TWV.
- g. The redistribution activity does not address configuration variations in the TWV.

the equipment redistributed. The measure is computed by aggregating shortages and requirements for all affected units at the redistribution site and provides a generalized measure of the effect on individual units.

b. Summary of Impacts

(1) Equipment/Software Impacts

(a) **Historical Data Processing.** Those aspects of the proposed system which involve historical data, namely the inspection and maintenance workloads, involve processing of data from hardcopy reports. This processing can be readily accomplished with microcomputer technology. Data bases of the pertinent historical data can be established and then manipulated with software accessing the databases.

(b) **Distribution Data Processing.** In the short term, those aspects of the system involving distribution data can benefit from application of a microcomputer to expedite data summary from databases generated from current TAEDP products. In the long term, new TAEDP products could be generated to create these summaries directly.

(2) Organizational Impacts

(a) **ARSTAF.** The proposed system anticipates that the ARSTAF would be the end user of the system products. The ARSTAF would task the system user (see MACOM, below) for system products on a recurring basis.

(b) **MACOM.** The proposed system anticipates that responsibilities for historical data analysis would be at the national item manager level, namely, the Tank-Automotive Command (TACOM) with support, as appropriate, from the Materiel Readiness Support Activity (MRSA). The generation of excess vehicle summaries, from current TAEDP products, will also be amenable to microcomputer technology and would also be conducted at the item manager level.

(3) Operational Impacts

(a) **ARSTAF.** The proposed system anticipates that the ARSTAF would generate tasking for system outputs and establish the requirements to phase in new TAEDP products to replace TAEDP-related microcomputer outputs. In addition, the ARSTAF would arrange for the generation of the TWV substitution ratios.

(b) **MACOM.** The proposed system anticipates that the MACOM (TACOM) would identify and acquire microcomputer hardware and commercially available software to implement the system, establish system data processing procedures, and assign, train, and supervise personnel in the use of the procedures.

d. Project the resources needed to bring the vehicles up to reissuable condition.

e. Project the improvement in the quantities of the equipment on hand achievable by redistribution.

2-3. METHODS AND PROCEDURES

a. **Summary of Improvements.** Current oversight of the redistribution of excess TWV is limited to a knowledge of the number of modernization vehicles which will be introduced into the force in a given year. It is assumed that this number indicates the number of excess vehicles which will be available for redistribution. This number, however, anticipates a one-for-one vehicle substitution and the usability of all the excess vehicles quantities. The proposed system provides for a quarterly estimate of redistribution quantities for the ensuing 2-year period and an annual estimate of redistribution for the ensuing 7-year period. The estimates address the issues of substitution ratios and the maintenance state of the excess vehicles. Further, the system considers the workloads associated with the redistribution and provides a measure of the improvement in the equipment on hand due to the redistribution.

(1) **Substitution Ratios.** The current practice assumes a one-for-one vehicle substitution. The proposed system provides for the identification and use of substitution ratios--that is, a ratio which indicates the number of vehicles made excess by the introduction of a particular new vehicle into the particular type of unit. A separate ratio is provided for each vehicle-pair, for each unit type involved in the redistribution (e.g., (1) M998 (HMMWV) for (2) M151 (TOW jeep) in an infantry battalion).

(2) **Maintenance State.** The current practice assumes all vehicles are available for redistribution. The proposed system employs historical data on the vehicle type being excessed, to establish the sensitivity of the maintenance expenditure level (MEL) to the percentage of vehicles (in the past) which could be economically repaired (see Appendix B). For a given MEL, this historically-determined percentage will be applied to the projected number of excess vehicles to establish the number of excessed vehicles which will be considered economically repairable.

(3) **Inspection and Maintenance Workload.** There is, at present, no estimate made of the effect of the redistribution on inspection and maintenance resources. The proposed system uses historically-based factors to estimate the workload associated with inspecting the excess vehicles and bringing them up to maintenance standards before reissue. This allows an assessment of these workloads as they impact on other demands for the personnel and facilities involved.

(4) **Equipment On Hand Improvement.** There is, at present, no estimate made of the effect of redistribution on the equipment holdings of units. The proposed system provides for both an absolute measure (quantity of equipment) and relative measure (percent of requirement) of the equipment

CHAPTER 2

SYSTEM SUMMARY

2-1. BACKGROUND

a. The functional description presented in this paper had its origin in a request by the Deputy Chief of Staff for Logistics to the US Army Concepts Analysis Agency (CAA) for assistance to the Office of the Deputy Chief of Staff for Logistics (ODCSLOG), Tank-Automotive Logistics Office (DALO-SMT). The problem was the management of the redistribution of tactical wheeled vehicles (TWV) made excess by the introduction of modernization equipment into the force.

b. An informal working relationship was established between CAA and DALO-SMT, and was maintained during April and May 1985. CAA participated in meetings with DALO-SMT and in meetings between DALO-SMT and elements of the Army Staff (ARSTAF) and Army Materiel Command (AMC). An understanding of the types of information necessary to manage the TWV redistribution activity developed from these meetings and from the feedback provided from DALO-SMT briefings to the Vice Chief of Staff of the Army (VCSA) on the management issues involved. These informal understandings served as the tasking guidance to CAA in the preparation of this functional description of a system to manage excess tactical wheeled vehicles.

c. The system described in this paper has several unique developmental aspects.

(1) The management effort for the redistribution of the TWV is representative of the management of other items of equipment to be made excess by the inflow of modernization items into the inventory. The system, therefore, should have a generic character allowing its application to other than TWV (e.g., radios). This generic character is illustrated by making only general references to types of equipment, with the implication that other equipment could be treated in a similar manner.

(2) The information system should be compatible with the need to directly implement the system in support of current redistribution activities, and also the need to subsequently integrate the system into the TAEDP as part of the ongoing development of the TAEDP.

2-2. OBJECTIVES. The system is to provide ODCSLOG with the capability to:

a. Project the number of excess TWV over time.

b. Project the number of excess TWV, which are economically repairable, to satisfy shortages.

c. Project the resources needed to inspect excess TWV for repair.

b. Points of Contact

(1) System Functional Description

US Army Concepts Analysis Agency
ATTN: CSCA-FSL
8120 Woodmont Avenue
Bethesda, Maryland 20814-2797

(2) System Developer

For the microcomputer configuration:
(To be determined)

For the TAEDP configuration:
Depot System Command
ATTN: AMSDS-S-M-LDD
Chambersburg, PA 17201-4170

(3) System Users (direct interface with system)

For the microcomputer configuration:
(To be determined)

For the TAEDP configuration:
Office of the Deputy Chief of Staff for Logistics
ATTN: DALO-SMD
Washington, DC 20310-1718

(4) System End User (user of system outputs)

Office of the Deputy Chief of Staff for Logistics
ATTN: DALO-SMT
Washington, DC 20310-1718

1-3. TERMS AND ABBREVIATIONS. See the glossary at the end of this publication.

(3) Inspection and Maintenance Projections

Display No: TWV /3/

Description: This display would indicate the inspection and maintenance projections for a particular redistribution site (installation or MACOM). These results are associated with the particular MEL applied as shown in the display.

Purpose: Provides quantitative estimates of the inspection and maintenance workloads as well as an estimation of the number of vehicles economically repairable. The number of excess vehicles economically repairable, by type, are the input to the corresponding TWV redistribution and improvement projections discussed and illustrated in the following paragraph (Display No. TWV /4/).

Illustration: (See Figure 3-4.)

TWV /3/

INSPECTION AND MAINTENANCE

RPT DATE: 10 JUN 85
DATA DATE: 31 MAY 85HORIZON: PLANNING
AREA: CONUS
SITE: FT HOOD

FY	TWV TYPE	INSPECTION ACTIVITY				MAINTENANCE ACTIVITY	
		TECH INSP TIME	MEL MAINT FRACTION	QTY EQP ECON TO REPAIR	QTY EQP UNECON TO REPAIR	MAINT TIME	MAINT COST
1	1						
	2						
	3						
	4						
2	1						
	2						
	3						
	4						
3	1					NOTE: SEPARATE DISPLAY GENERATED FOR EACH SITE IN CONUS AND OCONUS FOR PLANNING AND EXECUTION HORIZONS	
	2						
	3						
	4						
4	1						
	2						
	3						
	4						
5	1						
	2						
	3						
	4						
6	1						
	2						
	3						
	4						
7	1						
	2						
	3						
	4						

Figure 3-4. Inspection and Maintenance Projections

(4) TWV Redistribution and Magnitude and Improvement Projections

Display No: TWV /4/

Description: This display would indicate the magnitude of the redistribution and its improvement in on-hand equipment availability for a particular redistribution site (installation or MACOM).

Purpose: Provide estimates of the redistribution magnitude anticipated for a particular site and the improvement of equipment availability for that site. In addition to the redistribution of equipment at the site, the display also projects the "net excess" over redistribution requirements which is available for interinstallation (CONUS) transfer or backhaul to CONUS. This end disposition would be made by the national item manager, and is not included in the projection.

Illustration: (See Figure 3-5.)

TWV /4/		REDISTRIBUTION MAGNITUDE AND IMPROVEMENT									
		HORIZON: PLANNING AREA: CONUS SITE: FT HOOD									
FY	TW TYPE	REDISTRIBUTION					REDISTRIBUTED EOP				
		EXCESS EOP	SHORT EOP	TOTAL EOP	TOTAL EOP	TOTAL UNITS SHORT	TOTAL EOP	EOP SHORT	TOTAL EOP	NET REDIST EXCESS	PERCENT NET CHANGE
FY	TW TYPE	TOTAL UNITS EXCESS	TOTAL EOP REQD	TOTAL EOP ON HAND	TOTAL EOP EXCESS	TOTAL UNITS SHORT	EOP REQD	EOP ON HAND	EOP SHORT	NET REDIST SHORT	PERCENT ROWS AFTER
1	1	2	3	4	4	4	4	4	4	4	4
2	1	2	3	4	4	4	4	4	4	4	4
3	1	2	3	4	4	4	4	4	4	4	4
4	1	2	3	4	4	4	4	4	4	4	4
5	1	2	3	4	4	4	4	4	4	4	4
6	1	2	3	4	4	4	4	4	4	4	4
7	1	2	3	4	4	4	4	4	4	4	4

NOTE: SEPARATE DISPLAY
GENERATED FOR EACH SITE IN
CONUS AND OCONUS FOR PLANNING
AND EXECUTION HORIZONS

Figure 3-5. TWV Redistribution Magnitude and Improvement Projections

3-3. INPUTS-OUTPUTS

a. Inputs. The following types of data are input to the system based upon either analysis of historical data (maintenance factors) or current equipment TAEDP distribution data (unit excess quantities). The analysis of the historical data applies standard statistical techniques to past inspection reports for the vehicle types of interest. The analysis of the distribution data is an examination of the TAEDP REQVAL Report to identify those units which have excess quantities of the vehicles of interest. In addition, it may be necessary to interpret the excess data entries due to certain anomalies in the REQVAL report of unit equipment holdings (see Appendix C).

(1) **Maintenance Factors.** The maintenance factors are used to assess the workload imposed in meeting the requirements of AR 750-1 (Reference 1-2a(7)) before transferring the equipment from one unit to another. The factor values are based on historical data experience with the TWV involved, as recorded in inspection reports. Where substantial data differences dictate, separate factor values could be established for varied geographic areas or sites. The factors involved are as follows:

(a) **Average Inspection Time.** The average time, by type, it takes to inspect an excess TWV.

(b) **Average Maintenance Cost.** The average maintenance cost, by type, to bring an excess TWV up to standards, for the particular maintenance expenditure level being used.

(c) **Average Maintenance Time.** The average maintenance time, by type, to bring an excess TWV up to standards, for the particular maintenance expenditure level being used.

(d) **MEL Maintenance Fraction.** The fraction used to determine the number of excess vehicles, by type, which are economically repairable, given the maintenance expenditure level (MEL) being used (see Appendix B).

(2) Unit Equipment Quantities

(a) **Required Excess Type Equipment.** The required quantity of each excess type equipment, by unit, as determined from TAEDP products.

(b) **On-hand Excess Type Equipment.** The on-hand quantity of each excess type equipment, by unit, as determined from TAEDP products.

b. Outputs. The following values are output by the system based upon manipulation of the input data, using the computational procedure indicated. The values are displayed in the report formats described and illustrated earlier in paragraph 3-2f. The values are identified by the nomenclature used in the report headers and keyed to the reports in which they appear.

(1) Total Units Excess

(a) Display. TWV /1/, TWV /2/.

(b) Display Header. "TOTAL UNITS EXCESS"

(c) Value. The number of units at the redistribution site which have excess quantities of TWV equipment.

(d) Procedure. Use the Required and On-hand Excess-type Equipment inputs to identify and count the number of units with excess-type TWV equipment. For CONUS sites, count separately to establish the number of active units, reserve units, and guard units with excess-type equipment, then count again across these totals. For OCONUS, count by deployed units, war reserves, and POMCUS, then count again across these totals.

(2) Total Equipment Excess

(a) Display. TWV /1/, TWV /2/.

(b) Display Header. "TOTAL EQP EXCESS"

(c) Value. The quantity of excess equipment at the redistribution site.

(d) Procedure. Use the Required and On-hand Excess-type Equipment inputs. For each unit, take the difference between the required and the on-hand quantities to establish an excess (where it exists). For CONUS sites, sum separately to establish the excesses in active units, reserve units, and guard units, then sum again across these totals. For OCONUS, sum separately across deployed units, war reserves, and POMCUS, then sum again across these totals.

(3) Total Units Short

(a) Display. TWV /1/, TWV /2/.

(b) Display Header. "TOTAL UNITS SHORT"

(c) Value. The number of units at the redistribution site which are short quantities of excess-type TWV equipment.

(d) Procedure. Use the Required and On-hand Excess-type Equipment inputs to identify and total the number of units short excess-type equipment. For CONUS sites, count separately to establish the number of active units, reserve units, and guard units short TWV equipment, then count again across these totals. For OCONUS, count separately across deployed units, war reserves, and POMCUS, then count again across these totals.

(4) Total Short Equipment

- (a) **Display.** TWV /1/, TWV /2/.
- (b) **Display Header.** "TOTAL EQP SHORT"
- (c) **Value.** The quantity of short equipment at the redistribution site.
- (d) **Procedure.** Use the Required and On-hand Excess-type Equipment inputs. For each unit, take the difference between the required and the on-hand quantities to establish a shortage (where it exists). For CONUS sites, sum separately to establish the excesses in active units, reserve units, and guard units, then sum again across these totals. For OCONUS, sum separately across deployed units, war reserves, and POMCUS, then sum again across these totals.

(5) Technical Inspection Time

- (a) **Display.** TWV /3/.
- (b) **Display Header.** "TECH INSP TIME"
- (c) **Value.** The total amount of time spent inspecting each excess-type TWV at the redistribution site.
- (d) **Procedure.** Compute the product of the Average Inspection Time and the Total Excess Equipment for each excess-type equipment.

(6) Quantity of Equipment Economical to Repair

- (a) **Display.** TWV /3/.
- (b) **Display Header.** "QTY EQP ECON TO REPAIR"
- (c) **Value.** The number of excess-type TWV at the redistribution site which are economically repairable for a selected maintenance expenditure level (MEL) for that excess-type. (See Appendix B.)
- (d) **Procedure.** Compute the product of the MEL Maintenance Fraction and the Total Excess Equipment for each excess-type equipment.

(7) Quantity of Equipment Uneconomical to Repair

- (a) **Display.** TWV /3/.
- (b) **Display Header.** "QTY EQP UNECON TO REPAIR"
- (c) **Value.** The number of excess-type TWV at the redistribution site which are uneconomic to repair for a selected maintenance expenditure level (MEL) for that excess-type. (See Appendix B.)

(d) **Procedure.** Compute the product of (1 - MEL Maintenance Fraction) and the Total Excess Equipment for each excess-type equipment.

(8) Maintenance Time

(a) **Display.** TWV /3/.

(b) **Display Header.** "MAINT TIME"

(c) **Value.** The total time expended repairing excess-type TWV at the redistribution site.

(d) **Procedure.** Compute the product of the Average Maintenance Time for the excess-type TWV and the Quantity Economic to Repair, for each excess-type equipment.

(9) Maintenance Cost

(a) **Display.** TWV /3/.

(b) **Display Header.** "MAINT COST"

(c) **Value.** The total cost incurred in repairing excess-type TWV at the redistribution site.

(d) **Procedure.** Compute the product of the Average Maintenance Cost for the excess-type TWV and the Quantity Economic to Repair for each excess-type equipment.

(10) Total Units Excess

(a) **Display.** TWV /4/.

(b) **Display Header.** "TOTAL UNITS EXCESS"

(c) **Value.** The total of the totals of all units with excess TWV at the redistribution site.

(d) **Procedure.** See paragraph 3-3(1)(d).

(11) Total Equipment Required

(a) **Display.** TWV /4/.

(b) **Display Header.** "TOTAL EQP REQUIRED"

(c) **Value.** The sum of the required quantities of excess-type TWV for all units at the redistribution site.

(d) **Procedure.** Use the Required Excess-type Equipment inputs and sum across these quantities for all units at the site with an excess of the excess-type involved.

(12) **Total Equipment On-hand**

- (a) **Display.** TWV /4/.
- (b) **Display Header.** "TOTAL EQP ON HAND"
- (c) **Value.** The sum of the on-hand quantities of excess-type TWV for all units at the redistribution site.
- (d) **Procedure.** Use the **On-hand Excess Equipment** inputs and sum across these quantities for all units at the site with an excess of the excess-type involved.

(13) **Total Equipment Excess**

- (a) **Display.** TWV /4/.
- (b) **Display Header.** "TOTAL EQP EXCESS"
- (c) **Value.** The excess quantities of excess-type TWV of all units at the redistribution site.
- (d) **Procedure.** Compute the difference between the **Total Equipment on Hand** and the **Total Equipment Required** for each excess-type TWV, for all units with excesses at the redistribution site.

(14) **Total Units Short**

- (a) **Display.** TWV /4/.
- (b) **Display Header.** "TOTAL UNITS SHORT"
- (c) **Value.** The total of the totals of all units with TWV shortages at the redistribution site.
- (d) **Procedure.** See paragraph 3-3(4)(d).

(15) **Total Equipment Required**

- (a) **Display.** TWV /4/.
- (b) **Display Header.** "TOTAL EQP REQUIRED"
- (c) **Value.** The sum of the required quantities of excess-type TWV for all units at the redistribution site.
- (d) **Procedure.** Use the **Required Excess-type Equipment** inputs and sum across the quantities for all units at the site with a shortage of the excess-type involved.

(16) Total Equipment on Hand

- (a) **Display.** TWV /4/.
- (b) **Display Header.** "TOTAL EQP ON HAND"
- (c) **Value.** The sum of the on-hand quantities of excess-type TWV for all short units at the redistribution site.
- (d) **Procedure.** Use the **On-hand Excess-type Equipment** inputs and sum across the quantities for all units at the site with a shortage of the excess-type involved.

(17) Total Equipment Short

- (a) **Display.** TWV /4/.
- (b) **Display Header.** "TOTAL EQP SHORT"
- (c) **Value.** The short quantities of excess-type TWV of all units at the redistribution site.
- (d) **Procedure.** Compute the difference between the **Total Equipment on Hand** and the **Total Equipment Required** for each excess-type TWV, for all units with shortages at the redistribution site.

(18) Total Equipment Redistribution

- (a) **Display.** TWV /4/.
- (b) **Display Header.** "TOTAL EQP REDISTRIBUTION"
- (c) **Value.** The total quantity of the excess-type TWV redistribution to all units at the redistribution site.
- (d) **Procedure.** Compare the **Total Equipment Excess** (EXCESS) to the **Total Equipment Short** (SHORT), for each excess-type equipment. If EXCESS is greater than (SHORT), the total redistribution is the SHORT amount. If EXCESS is less than SHORT, the total redistributed is the EXCESS amount.

(19) Net Redistribution Excess

- (a) **Display.** TWV /4/.
- (b) **Display Header.** "NET REDIST EXCESS"
- (c) **Value.** The total quantity of the excess-type TWV excess following redistribution to all units at the redistribution site.

(d) **Procedure.** Compare the **Total Equipment Excess** (EXCESS) to the **Total Equipment Short** (SHORT), for each excess-type equipment. If EXCESS is greater than SHORT, the net redistribution excess is the difference between EXCESS and SHORT. If EXCESS is less than SHORT, the net redistribution excess is zero.

(20) Net Redistribution Short

(a) **Display.** TWV /4/.

(b) **Display Header.** "NET REDIST SHORT"

(c) **Value.** The total quantity of the excess-type TWV short following redistribution to all units at the redistribution site.

(d) **Procedure.** Compare the **Total Equipment Excess** (EXCESS) to the **Total Equipment Short** (SHORT), for each excess-type equipment. If EXCESS is greater than SHORT, the net redistribution SHORT is zero. If EXCESS is less than SHORT, the net redistribution short is the difference between EXCESS and SHORT.

(21) Percent Requirements Before

(a) **Display.** TWV /4/.

(b) **Display Header.** "PERCENT RQMTS BEFORE"

(c) **Value.** The ratio of **Total Equipment on Hand**, before redistribution to the **Total Equipment Required**, expressed as a percentage.

(d) **Procedure.** Compute the above ratio.

(22) Percent Requirements After

(a) **Display.** TWV /4/.

(b) **Display Header.** "PERCENT RQMTS AFTER"

(c) **Value.** The ratio of **Total Equipment on Hand**, before redistribution increased by the **Total Equipment Redistributed** to the **Total Equipment Required**, expressed as a percentage.

(d) **Procedure.** Compute the above ratio.

(23) Percent Net Change

(a) **Display.** TWV /4/.

(b) **Display Header.** "PERCENT NET CHANGE"

(c) **Value.** The difference between the **Percent Requirements Before** and **Percent Requirements After**.

(d) **Procedure.** Compute the above difference.

3-4. FAILURE CONTINGENCIES. Not applicable.

3-5. SECURITY

a. **Redistribution Data.** The redistribution data (inputs and outputs) are classified CONFIDENTIAL.

b. **Maintenance Factors.** The maintenance factors (inputs) are UNCLASSIFIED.

CHAPTER 4

SYSTEM DEVELOPMENT PLAN

4-1. DEVELOPMENT TASKS. The implementation of the information system must provide for developments in two basic areas: data development and the application development itself. The data development provides for those data elements needed by the system which are not currently available in a form useful to the system. The application development provides for both implementation of a microcomputer capability and, in the longer term, TAEDP enhancements which will serve the information needs of the system.

a. Data Development

(1) **Maintenance Factors.** The development of the maintenance factors, which includes both the inspection and repair aspects, is based on the availability of the raw data from existing technical inspection records. Using this source, the necessary data (see Chapter 3, paragraph 3-3a(1)) can be generated by standard statistical techniques for computation of mean values.

(2) **Substitution Ratios.** The data on substitution ratios is not directly derivable, in a mathematical sense, from existing documentation. To arrive at the ratios, the combat developer documentation must be examined to establish the vehicle types in the modernized units and then compare these with the corresponding vehicle types present in the units before modernization. It may, in fact, be possible to determine from the combat developers whether any policy or practice for vehicle substitution was employed in the design process. Lacking any such standard, a unit-type by unit-type comparison would be needed to determine the number of vehicles excessed from a unit, by the introduction of a newer type vehicle. In general, what is sought are the cases of substitution where other than a one-for-one ratio is involved. It may be possible to isolate these cases, before actually carrying out the assessment, and avoid the need to examine numerous one-for-one cases. The final product of the analysis would be a table by unit type (i.e., Standard Requirements Code), indicating the substitution ratios for the vehicle types of interest.

b. Application Development

(1) **Microcomputer-based Development.** The microcomputer-based development of the system presumes access to a machine, a database package, a spreadsheet package, a graphics package, and personnel proficient in their use. The database package would be used to hold the data elements associated with computation of equipment excesses organized by horizon, area, and site. The spreadsheet package would be used to compute the inspection and maintenance workloads, excess equipment, and rating changes. The spreadsheets would also be used to display summary results in tabular form. The graphics package would be used to convert summary tabular data into graphics form for use in preliminary data analysis and for data presentation.

(2) **TAEDP Based Development.** The TAEDP presently provides values for excess equipment as part of the monthly REQVAL report (Reference 1-2a(2)). These values, however, are extremely time sensitive, and while they may be reasonably well reflected in the monthly TAEDP product, they cannot, at the present time, be considered current in the semiannual TAEDP products. Other initiatives, outside the scope of this paper, are underway to address this area. In addition, there is the question of the substitution ratio. For a meaningful assessment of excess vehicles, TAEDP must have available a table of substitution ratios to apply to the individual units, by unit type, as it carries out distribution. When such a table is available, the TAEDP could be modified to both determine the excess vehicles and provide for their redistribution to short units.

4-2. DEVELOPMENT TIMEFRAMES. The estimates of timeframes desirable for accomplishing the system developments are summarized in Table 4-1. The table reflects the need to support the redistribution activity with an oversight system as soon as possible, but does not reflect consideration of current workloads or priorities of the activities which would be tasked to perform the work.

Table 4-1. Development Timeframes

Development	Complete during
Maintenance factors	2d Quarter FY 86
Substitution ratios	2d Quarter FY 86
Micro-based applications	2d Quarter FY 86
TAEDP-based applications	2d Quarter FY 87



INFORMATION SYSTEM FOR MANAGEMENT OF EXCESS
TACTICAL WHEELED VEHICLES - FUNCTIONAL DESCRIPTION
(Analytic Assistance to the Tank-Automotive
Logistics Office - ATALO)

STUDY
SUMMARY
CAA-TP-85-7

THE REASON FOR PERFORMING THE STUDY was to incorporate a systems analysis perspective into the planning for the Army staff management of the redistribution of tactical wheeled vehicles made excess by the introduction of modernization vehicles into the force.

THE PRINCIPAL FINDING was that the Army Staff will require ongoing information on the availability of excess equipments and on shortages of such equipment in other units which can be satisfied by the excess equipment.

THE MAIN ASSUMPTION was that Total Army Equipment Distribution Program data products would be sufficiently timely to permit identification of excesses and shortages.

THE PRINCIPAL LIMITATION was that ARSTAF guidance limited vehicle redistribution by geographic areas, namely within installations in the Continental United States (CONUS), and within major Army commands outside CONUS.

THE SCOPE OF THE STUDY was limited to tactical wheeled vehicles, although the methodology for management would be applicable to other types of equipment, e.g., radios.

THE STUDY OBJECTIVE was to provide ARSTAF logisticians with a quantitative basis for the management of the redistribution of excess tactical wheeled vehicles, including associated maintenance resource requirements.

THE BASIC APPROACH was to: (1) determine the information required to provide an Army staff overview of the availability and potential redistribution of excess vehicles, (2) evaluate the sources of data available and the processing of the data necessary to fulfill these information requirements, (3) define an information system encompassing these elements in a structured manner, and (4) document the system in a Functional Description for an Information System for Management of Excess Tactical Wheeled Vehicles (CAA Technical Paper 85-7).

THE STUDY SPONSOR was the Chief, Tank-Automotive Logistics Office (DALO-SMT).

THE STUDY EFFORT was directed by Mr. James J. Connelly, Force Systems Directorate.

COMMENTS AND QUESTIONS may be directed to the Director, US Army Concepts Analysis Agency, ATTN: CSCA-FS, 8120 Woodmont Avenue, Bethesda, Maryland 20814-2797.



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CAA-TP-85-7

MACOM	major Army command
MEL	maintenance expenditure level - The amount, not to be exceeded, to repair a piece of equipment--usually expressed as a percent of the current replacement cost for the item
MRSA	Material Readiness Support Activity
OCONUS	outside Continental United States
ODCSLOG	Office, Deputy Chief of Staff for Logistics
POM	Program Objective Memorandum
POMCUS	prepositioned materiel configured to unit sets
QFY	quarter of a fiscal year
redistribution site	see site
REQVAL	TAEDP monthly Requisition Validation Report
rqmts	requirements
site	A particular military complex within a geographic area used for redistribution projection. For CONUS, the sites are support installations (see Reference 4). For OCONUS, the sites are MACOMs, specifically, the seven identified in TAEDP coding (i.e., Europe, Southern European Task Force, Korea, Pacific, Alaska, WESTCOM, and Panama)
TACOM	Tank-Automotive Command
TAEDP	Total Army Equipment Distribution Program
TWV	tactical wheeled vehicle
VCSA	Vice Chief of Staff of the Army

GLOSSARY**TERMS AND ABBREVIATIONS**

AMC	Army Materiel Command
AR	Army Regulation
area	The geographic area included in the redistribution projection. The area is either the Continental United States (CONUS) or outside of CONUS (OCONUS)
ARSTAF	Army Staff
ASIOE	associated support items of equipment
CBS-X	Continuing Balance System, Expanded
CONUS	Continental United States
DESCOM	Depot System Command
DOD	Department of Defense
eqp	equipment
excess equipment	Equipment made excess to a unit by the issue of a more modern item. This definition is equivalent to that for "displaced equipment" in Reference 3. It reflects the usage adopted in briefings, by DALO-SMT, to the VCSA
excess-type equipment	a generic term used to indicate a type of excess equipment (e.g., M151, M880)
FY	fiscal year
horizon	The time period for which the system projects data. The horizon is 2 years when quarter fiscal year periods are used, and the horizon is 7 years when 1-year fiscal year periods are used
HQ	headquarters
information system	A formalized set of procedures involving people, information, and equipment that transform data into information in a structured, consistent, and meaningful manner. Such a system could consist of manual, automated, or manual and automated procedures
LEA	Logistics Evaluation Agency

APPENDIX C

STATUS OF DISTRIBUTION DATA

C-1. GENERAL SITUATION. The reporting of equipment assets in TAEDP products, including REQVAL, takes the form of a unit-by-unit report of equipment holdings against requirements. Where the requirement for a piece of equipment and an associated quantity on hand exists, a simple difference calculation will indicate if the equipment on hand is less than, equal to, or greater than the requirement. In this circumstance, excesses over the requirement can be rapidly identified and culled out. The more troublesome case is where a unit reports equipment on hand, but without an indication of a requirement for the equipment. In this instance, the equipment might be considered excess but, in general, it is serving the unit "in lieu of" or as a substitute for another piece of equipment. This correlation is not present in the REQVAL Report and must be established by reference to other documentation (Reference 1-2a(8)), defining allowable substitutions or by reference to the individual unit status report which may provide clarifying comments on the situation. It can be concluded that the REQVAL Report, in and of itself, cannot provide completely reliable data on unit holdings and, by extension, on holdings of excess equipment.

C-2. REMEDIAL EFFORTS. The impact of the use of substitute items in the reporting of unit holdings has been under consideration for several years.

a. **AMC.** AMC prepared a pamphlet defining a Class VII substitution list (Reference 1-2a(6)). This pamphlet, however, only covers equipment-type substitution and does not go into the matter of substitution ratios--that is, the number of one item of equipment which substitutes for another. This could be particularly significant in the generating of excess quantities of equipment and is commented upon in the main text.

b. **LEA.** LEA has developed an automated system, the Logistics Readiness Rating Report, to deal with gaps in equipment reporting. In particular, the "WRITE-1" report of the system can be formatted to provide listings keyed to the item manager. In the case of the TWV, the report could be set to list TACOM-managed equipment. This listing would reflect adjustments made by the system for substitutions and would provide an improved set of data for generating excesses.

c. **ODCSLOG.** The ODCSLOG Readiness Office (DALO-PLR) has recently been tasked by the DCSLOG to revisit the area of substitution and assist in overcoming shortcomings in the present systems.

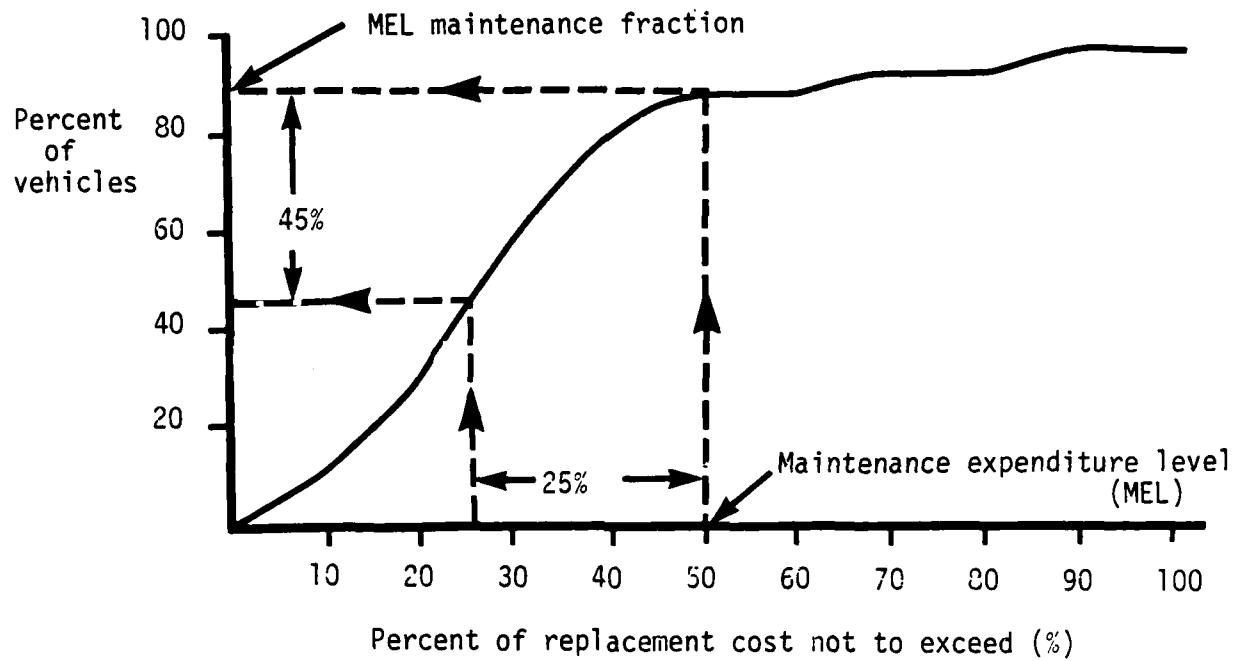


Figure B-4. MEL Sensitivity Analysis Example

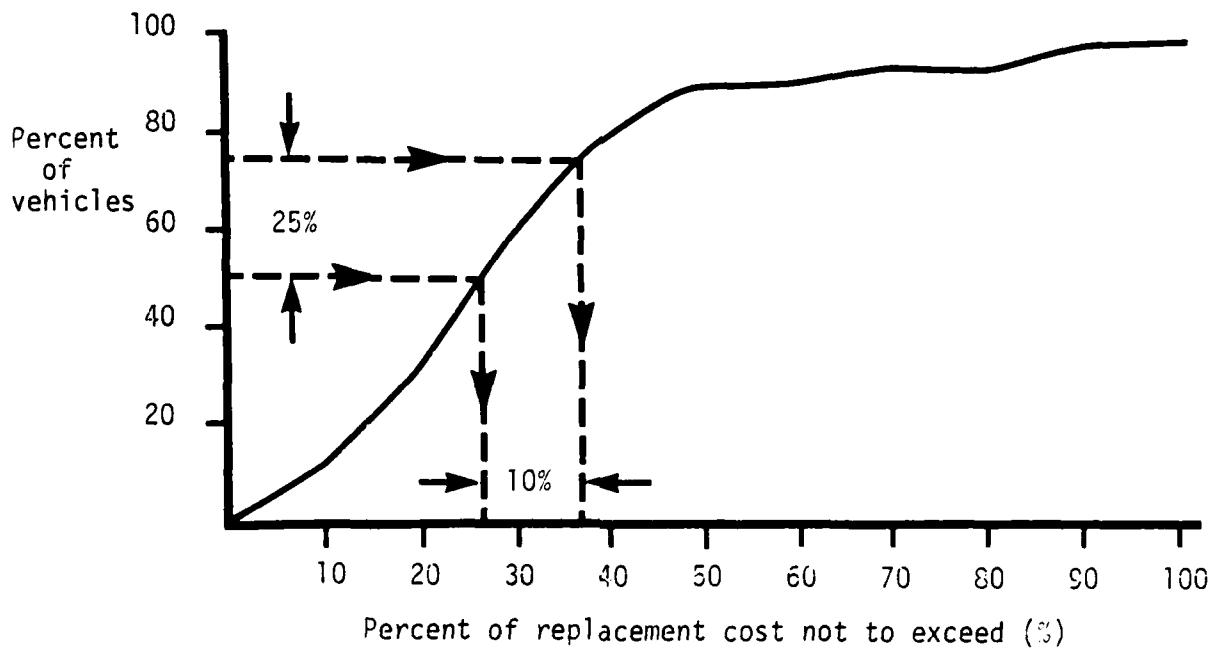


Figure B-5. Vehicle Sensitivity Analysis Example

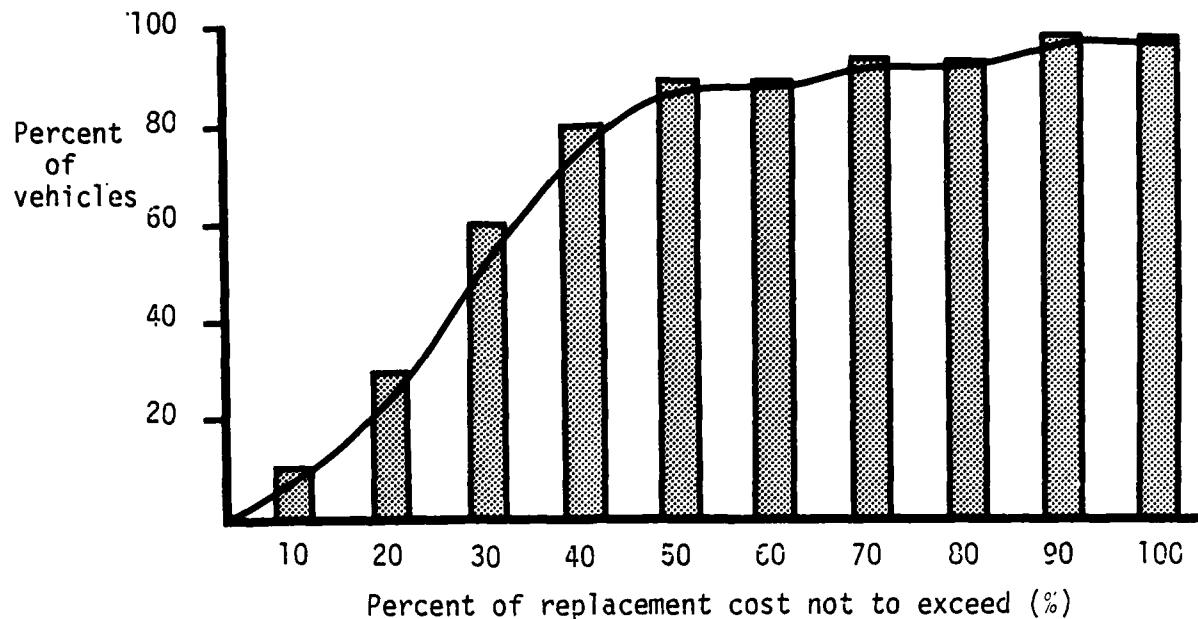


Figure B-3. Step 3 - Replace Cumulative Distribution with Smooth Curve

B-4. SENSITIVITY ANALYSIS. The sensitivity analysis can take two basic forms as discussed in the following paragraphs.

a. **MEL Sensitivity.** In this form of the analysis, the question of sensitivity may be put in the form: What is the increase in the number of vehicles available as the MEL is increased from, say, 25 percent to 50 percent? The sensitivity is taken from the curve by projecting from the 25 percent and 50 percent points on the x-axis to the curve and then projecting across to the y-axis as shown in Figure B-4. For this example, the 25 percent increase in MEL produces a 45 percent increase in the number of vehicles. The significance of these values and others similarly obtained must be assessed by the user in terms of the larger redistribution concerns for costs and the need for vehicles.

b. **Vehicle Sensitivity.** In this form of the analysis, the question of sensitivity may be put in the form: What is the increase in the maintenance cost, as the number of vehicles to be made available for redistribution is increased from, say, 50 percent to 75 percent? In this case, the sensitivity is taken by projecting from the 50 percent and 75 percent points on the y-axis to the curve, and then projecting down to the x-axis as shown in Figure B-5. For this example, the 25 percent increase in the number of vehicles is accomplished with only a 10 percent increase in the MEL. Again, the significance of these values and others similarly obtained must be assessed by the user in terms of the larger redistribution concerns for costs and the need for vehicles.

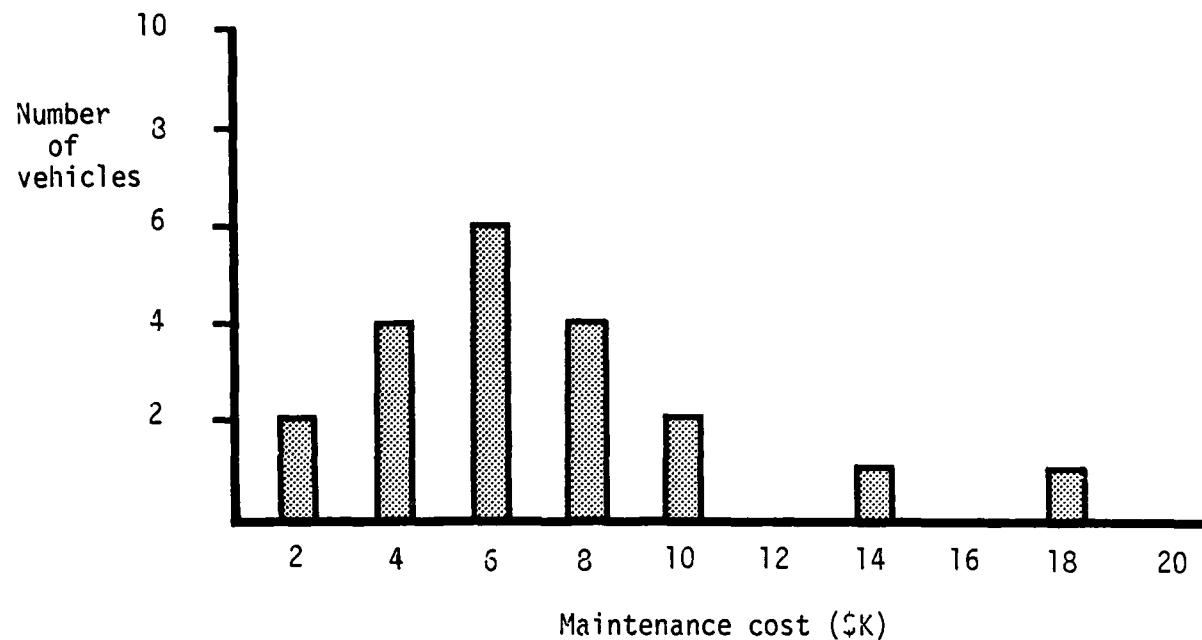


Figure B-1. Step 1 - Convert Source Data to Frequency Distribution

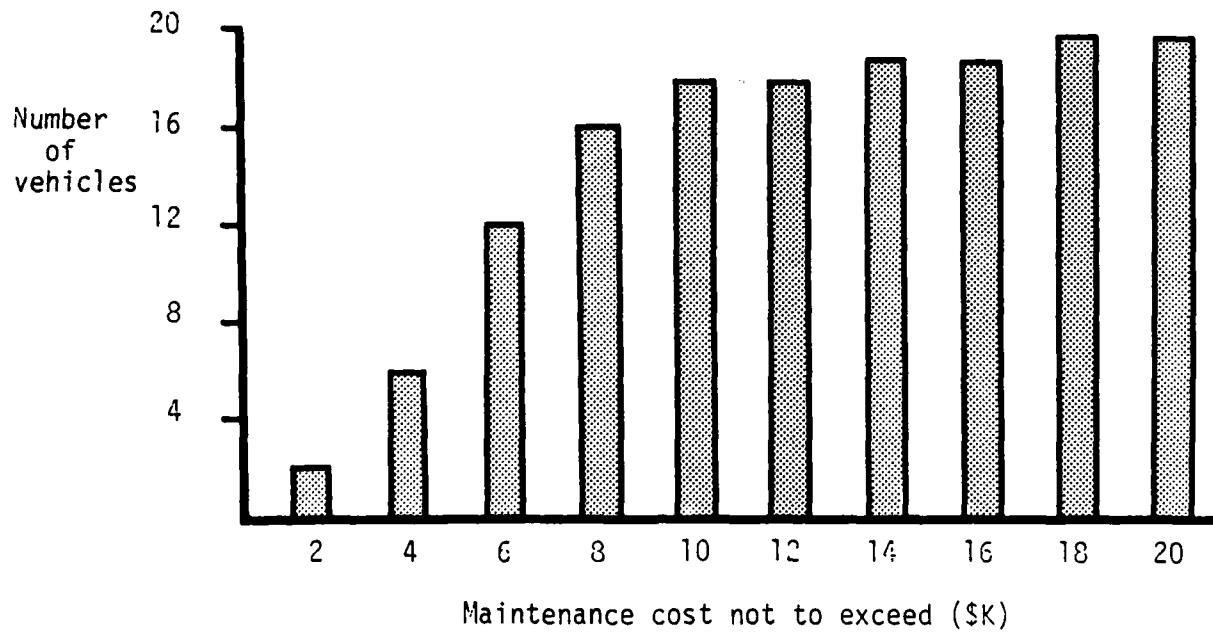


Figure B-2. Step 2 - Convert Frequency Distribution to Cumulative Distribution

Table B-1. MEL Source Data

Vehicle - type 1	Maintenance costs ^a
1	\$ 2,000
2	2,000
3	4,000
4	4,000
5	4,000
6	4,000
7	6,000
8	6,000
9	6,000
10	6,000
11	6,000
12	6,000
13	8,000
14	8,000
15	8,000
16	8,000
17	10,000
18	10,000
19	14,000
20	18,000

^aHypothetical data for illustrative purposes.

B-3. DATA REDUCTION. The table data is reduced into a form suitable for sensitivity analysis by first converting it into a histogram of maintenance cost versus number of vehicles involving that cost. For convenience, the cost would be taken at some convenient intervals, say \$2,000 increments. The resultant histogram, based on the Table B-1 data, looks as shown in Figure B-1. The sensitivity analysis would be derived from this histogram by transforming it into a cumulative distribution. That is, a plot of the number of vehicles which are at or below a given maintenance cost. The resultant cumulative distribution is as shown in Figure B-2. The final step is to convert both the x- and y-axis to percentage scales. To do this, the x-axis is marked off in percentage of replacement cost for the vehicle. The y-axis is marked off in percentage of the total number of vehicles present. As part of the rescaling, the bars are replaced by points corresponding to the tops of the bars and a smooth curve passed through these points. The resulting rescaled cumulative distribution is shown in Figure B-3.

APPENDIX B

MEL SENSITIVITY ANALYSIS

B-1. PURPOSE. The maintenance expenditure level (MEL) sensitivity analysis has as its purpose the establishment of the relationship between the investment to be made in TWV maintenance and the return on the investment in the form of additional TWV which become available for redistribution. More investment always generates more return, so the question becomes at what point does the rate of return no longer justify the rate of investment to achieve it. The sensitivity analysis introduces quantitative values for the rate of investment and rate of return to permit a judgment to be made as to the desired level of investment for value received.

B-2. SOURCE DATA. The source data for the sensitivity analysis are the historical maintenance estimates for each excess-type TWV. This would be the inspection reports for individual vehicles over some convenient period, say 1 to 2 years. The data to be collected is simply the maintenance cost for each vehicle of interest, ranging over all encountered degrees of maintenance required from minimal to maximal. The maintenance costs are then arrayed in a table of increasing cost. To illustrate the data situation, a short tabulation of hypothetical data is shown in Table B-1. In the actual case, the table would have appreciably more entries.

APPENDIX A
CONTRIBUTORS

1. STUDY TEAM

a. Study Director

Mr. James J. Connelly, Force Systems Directorate

b. Ad Hoc Assistance

Mr. Howard E. Whitehead

2. PRODUCT REVIEW BOARD

LTC Charles E. Gettig, Jr., Chairman

Ms Vera W. Hayes

Ms Sally Van Nostrand

3. EXTERNAL CONTRIBUTORS

COL David L. Asbury, Chief, Tank-Automotive Logistics Office, ODCSLOG

MAJ Paul Setcavage, Logistics Evaluation Agency

Mr. Les C. Cunningham, Chief, Equipment, Planning and Distribution Division, ODCSLOG

Mr. John Dugan, Tank-Automotive Command

Mr. Eugene Sorice, Tank-Automotive Command

LTC Edward P. Page, Tank-Automotive Logistics Office, ODCSLOG

THE STUDY SPONSOR was the Chief, Tank-Automotive Logistics Office (DALO-SMT).

THE STUDY EFFORT was directed by Mr. James J. Connelly, Force Systems Directorate.

COMMENTS AND QUESTIONS may be directed to the Director, US Army Concepts Analysis Agency, ATTN: CSCA-FS, 8120 Woodmont Avenue, Bethesda, Maryland 20814-2797.



INFORMATION SYSTEM FOR MANAGEMENT OF EXCESS
TACTICAL WHEELED VEHICLES - FUNCTIONAL DESCRIPTION
(Analytic Assistance to the Tank-Automotive
Logistics Office - ATALO)

STUDY
SUMMARY
CAA-TP-85-7

THE REASON FOR PERFORMING THE STUDY was to incorporate a systems analysis perspective into the planning for the Army staff management of the redistribution of tactical wheeled vehicles made excess by the introduction of modernization vehicles into the force.

THE PRINCIPAL FINDING was that the Army Staff will require ongoing information on the availability of excess equipments and on shortages of such equipment in other units which can be satisfied by the excess equipment.

THE MAIN ASSUMPTION was that Total Army Equipment Distribution Program data products would be sufficiently timely to permit identification of excesses and shortages.

THE PRINCIPAL LIMITATION was that ARSTAF guidance limited vehicle redistribution by geographic areas, namely within installations in the Continental United States (CONUS), and within major Army commands outside CONUS.

THE SCOPE OF THE STUDY was limited to tactical wheeled vehicles, although the methodology for management would be applicable to other types of equipment, e.g., radios.

THE STUDY OBJECTIVE was to provide ARSTAF logisticians with a quantitative basis for the management of the redistribution of excess tactical wheeled vehicles, including associated maintenance resource requirements.

THE BASIC APPROACH was to: (1) determine the information required to provide an Army staff overview of the availability and potential redistribution of excess vehicles, (2) evaluate the sources of data available and the processing of the data necessary to fulfill these information requirements, (3) define an information system encompassing these elements in a structured manner, and (4) document the system in a Functional Description for an Information System for Management of Excess Tactical Wheeled Vehicles (CAA Technical Paper 85-7).

THE STUDY SPONSOR was the Chief, Tank-Automotive Logistics Office (DALO-SMT).

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